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INDIANA UNIVERSITY

An Analytical Study of January-February (1943) Entering Freshmen at Indiana University

By

WILLIAM H. FOX

A List of Bulletins in the Field of Education, Indiana University

By

KATHLEEN DUGDALE

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An Analytical Study of January-February (1943) Entering Freshmen at Indiana University

WILLIAM H. FOX

INTRODUCTION

THE January-February (1943) group of freshmen at Indiana University differs from a normal group in several respects. To begin with, this class entered in the midst of conditions which were non-normal because of the effects of a constantly changing program in wartime. The University has made substantial changes both in curriculum and length of school term since the war began. It has realized that the curriculum must be flexible in order that both the regular program and instruction for various branches of the armed services may be offered. Today there is more demand for those courses which bear directly upon military needs. There is also a speeding-up process, designed to crowd achievement into fewer weeks, in order that students may be more rapidly prepared for service. The 18-week semester has been crowded into 15 weeks. The five-day week has virtually become a six-day week. Assignments are increased proportionately. There is less emphasis on the social side of University life, more on the serious side. Into such a picture this group has come; some of them, no doubt, with the old traditional idea of just "getting a college education"; most of them with a sincerity of purpose much stronger than that found in normal years.

Most students begin higher education in the fall, which indicates that the group being studied has already felt the effects of a speed-up program. The name "January-February" suggests the expediency employed in getting young people along the educational pathways as quickly as possible. Some entered in January at the close of a high school semester where the school term lasts eight months; others entered in February after a longer semester. Both groups contain a sizable percentage who, at the time of their entrance, lacked from a few weeks to a whole semester of graduating from high school. Since the university courses of each group follow more or less coterminous lines, the two groups have been studied as a unit.

Problems Involved.—It is logical to believe that the January-February freshmen as a group would be somewhat above average in several respects. The excellent opportunities for work at high wages would take their toll of potential college material. Then, too, many of the boys would not wait to be drafted, but would enlist in order to have some control over the type of service they were entering. Such factors tend to select those of higher ability for continued education because the students who enter college are those who are sufficiently interested in a college education to go on to school in spite of attractive opportunities elsewhere.

But such a hypothesis must be proved. *The first problem, then, is to compare the group with a more normal group.* For this purpose a sample has been taken from the September (1942) freshmen. One might argue, and rightly, that it would be better to go back further, probably to a prewar class. It is believed, however, that the January-February group differs substantially enough to allow a reasonable comparison. Also, if significant differences could be shown between these two groups, it is logical to suppose that even more significant differences may exist in relation to prewar groups. At least the effects of one variable could be minimized, that of emotional duress, since both groups have been similarly affected.

The second problem is to analyze the group, using personal data, to determine what type of student is entering college under total war conditions. Involved in this problem are such factors as age, geographic distribution, family status, parental occupation, and vocational preference.

The fact that a considerable proportion of the group is accelerated suggests *the third problem, to compare these accelerated students with the remainder of the group.* If the group as a whole is different from a more normal group, it is desirable to know to what extent these differences may be attributed to the extra selectivity which one might expect from such acceleration. It is not even known whether these people show the high selectivity usually associated with acceleration. All who enter the University without graduating from high school have been recommended by the high school principals. Otherwise, little is known concerning them.

It is likely, depending on the duration of the war, that several more classes will enter Indiana University under similar conditions. *The fourth and final problem, then, is to attempt to predict achievement of succeeding groups, using the achievement of the January-February class as a criterion.* In this problem it is necessary to examine carefully each item of data to see what items may be used most successfully both as single predictive measures and in combination. It is well recognized that the smallness of the class tends to decrease the accuracy of the prediction—there are only 170 enrollees in the group for whom all data are available. However, similar treatment of succeeding classes should make it possible to set up more accurate equations.

Sources of Data.—The University gives two standardized tests to each of its new entrants. The tests used are the Cooperative English Test, Form PM, and the ACE Psychological Examination, 1941 Edition, both of which are published by the American Council on Education. The Cooperative English Test has four parts: namely, English Usage, Spelling, Vocabulary, and Total. The Psychological Examination has three parts: Linguistic, Quantitative, and Total.

The high school transcripts are available for checking achievement averages and vital statistics.

Each freshman is required to submit an application for admission to the University. These applications contain many items of personal data.

The grade-point ratios, taken from the official records, for the first semester have been used as criteria for prediction.

Methods and Techniques.—Data have been collected and assembled from the available records, master sheet techniques being employed for this purpose. From these master sheets the various tables and figures have been compiled.

The statistical treatment used in this study involves the computation of means and standard deviations and a comparison of these for establishing reliability of differences. Samples have been tested for significance of divergence from normality. Coefficients of correlation have been computed by the product-moment method. These in turn have been used to establish relationships and to construct regression equations for predictive purposes.

COMPARISON OF THE JANUARY-FEBRUARY GROUP WITH A SAMPLE TAKEN FROM A MORE NORMAL GROUP

Sources of Data.—It has already been stated that, for purposes of comparison, a sampling of the September (1942) freshmen has been used. Data consist of scores on the ACE Psychological Examination and the Cooperative English Test. Percentiles are also used in various comparisons.

Statistical Methods and Procedures.—Methods and procedures used may be summarized as follows:

(*a*) Construction of distribution tables
(*b*) Calculation of the mean and standard deviation for each distribution
(*c*) Calculation of the standard error of the mean of each distribution
(*d*) Calculation of the standard error of the difference between means
(*e*) Determining for each set of comparable items the ratios of actual difference to the standard error of difference in order to test the significance of difference.

The September group used in this study is a sampling of a larger group, and consists of 196 students selected at random, using roughly every eighth person. Assuming the distribution of the whole September group to be normal, it has been thought desirable to apply the *chi* square formula for goodness of fit to the distribution of the sample. This formula is written,

$$X^2 = \Sigma\left(\frac{(fo - f)^2}{f}\right)$$

in which fo represents the obtained frequencies and f represents the theoretical or normal frequencies (5, page 123).* The *chi* square for the distribution of Psychological Examination scores for the September sampling was found to be 5.99. When interpolated from a table made up for this purpose, this number indicates that P (or

* Numbers refer to references in the bibliography at the end of this study.

probability) is .74, or that the chances are 74 in 100 that any deviations of the sample distribution from normality are attributable to the fluctuations of random sampling. Since P must be .02 or less before a distribution is considered to deviate significantly, we can say that the sample is a very close fit to normality, and is therefore a good one (5, pages 119-129). By the same test the *chi* square of the Cooperative English Test distribution is 8.19, and P is .32. While this result is not as good as the former, we can still say that the sample is a "good fit."

Early in the investigation it became apparent that there were rather large differences between sexes. This fact suggested the advisability of studying girls and boys separately, as well as of making a study of the group as a whole.

Comparisons Using the Psychological Examination.—Table I is a compilation of results of various measures of central tendency, variability, and reliability of differences involving the January-February and September group scores on the Psychological Examination. On the quantitative part of this test, involving arithmetic problems, figure analogies, and number series, both boys and girls of the January-February group did much better than those of the September group. The boys of the former group averaged more than six score units higher than those of the latter, with girls ranking even higher. Also, the January-February people were less variable, as illustrated by the difference between the two groups of slightly more than three points in standard deviation.

When the difference in means is tested for significance, it is found that for each separate classification studied—boys, girls, and combined group—the chances are virtually certain that the younger group will always rate ahead of the sample on this aspect of intelligence as measured by the test. If the two groups are typical of other entering freshman groups, we might expect to find the same results from similar situations at Indiana University.

An examination of percentiles made by the January-February group on the quantitative test shows that the boys rank in the seventy-third percentile, girls in the sixty-fourth, and the combined group in the seventieth. In comparison, the September group shows boys in the fifty-second, girls in the fortieth, and the combined group in the forty-sixth percentile.

The linguistic part of the Psychological Examination consists of completion, same-opposite, and verbal analogies problems. The data for boys show that there are 84 chances in 100 that the January-February group will always rate above the September group on this part of the test. The January-February girls do not evidence such superiority, the data showing that the chances are only 54 in 100 that they will always rate above girls of the September group, and this is little better than an even chance.

In all cases the difference in means could easily be accounted for by the standard error of the means. There is not much superiority in percentiles, the greatest difference being only four points.

The heavier weighting of the quantitative part of the test, coupled

TABLE I. COMPARISON OF JANUARY-FEBRUARY AND SEPTEMBER GROUPS USING SCORES ON THE ACE PSYCHOLOGICAL EXAMINATION

	January-February group					September group					Reliability of differences			
	No.	Mean	Percentile rank	σ Mean	σ	No.	Mean	Percentile rank	σ Mean	σ	Actual diff.	σ Diff.	$\frac{D}{\sigma D}$	Chances in 100
QUANTITATIVE														
Boys	117	46.41	73	$\pm$ .82	8.85	96	40.31	52	$\pm$1.33	12.10	6.10	1.56	3.91	100
Girls	53	43.40	64	$\pm$1.27	9.25	100	36.85	40	$\pm$1.22	12.15	6.55	1.76	3.72	100
Total	170	45.47	70	$\pm$ .70	9.10	196	38.54	46	$\pm$ .88	12.25	6.92	1.12	6.18	100
LINGUISTIC														
Boys	117	67.99	62	$\pm$1.38	14.95	96	66.06	56	$\pm$1.31	12.88	1.93	1.90	1.02	84
Girls	53	67.95	62	$\pm$2.12	15.40	100	67.70	61	$\pm$1.50	14.95	.25	2.60	.10	54
Total	170	67.94	62	$\pm$1.15	15.05	196	66.90	59	$\pm$1.00	14.00	1.04	1.52	.68	76
TOTAL														
Boys	117	114.03	69	$\pm$1.95	21.10	96	107.19	58	$\pm$2.28	22.30	6.84	3.00	2.28	99
Girls	53	109.84	63	$\pm$3.06	22.30	100	105.00	54	$\pm$2.34	23.40	4.84	3.85	1.26	89
Total	170	112.74	67	$\pm$1.65	21.50	196	106.07	55	$\pm$1.63	22.90	6.67	2.32	2.88	99.8

with the superior ratings on this part by the January-February group, tend to produce rather significant differences in the test total scores. The difference in means is 4.84 for the girls and 6.84 for the boys, both in favor of the January-February group, which indicates that the chances are 99 in 100 for the boys and 89 in 100 for the girls that the January-February students will always rate higher than the September group on this test. The variability of the groups is not significantly different. On the average there is a percentile superiority of about ten points in favor of the January-February students.

It has been found that there are important advances in level of intelligence of college students in periods of nonnormal economic conditions (14). Also, more effective guidance, especially among men, has resulted in slight gains in the level of academic intelligence (15). It would appear, then, that both of these selective factors are operating together as conditioning elements in the findings; and that, in addition, there may be other causes, since the differences are so marked in groups separated by only a few months in chronological age.

It will be pointed out later that the January-February class comes mostly from the high schools in Indiana, with few students from other states. In a very recent study of Indiana high school seniors, taking this same Psychological Examination, Eaton, using high school norms, found the senior students in Indiana to average around the fiftieth percentile on all three parts of the test (4). This serves to further emphasize the selected quality of the group being studied.

Allison and Barnett found reliable differences in both the quantitative and the linguistic parts of the Psychological Examination in favor of students from large centers (1). Since only an insignificant portion of the January-February class come from rural communities, this might point out another factor in the higher test scores.

Comparisons Using the Cooperative English Test.—The Cooperative English Test consists of four parts; namely, English Usage, Spelling, Vocabulary, and Total. Table II is a compilation of measures of central tendency, variability, and reliability of differences involving the January-February and September group scores on this test. There are no absolutely reliable differences between the two groups on any part of this test. In English usage the January-February group rates somewhat higher than the September group, with the boys showing the most advantage. However, the September students show some superiority in both spelling and vocabulary.

On all units of the test the percentiles are relatively low, ranging from 32 to 51. In the January-February group the highest percentile for girls is 51, on English usage; for boys, 43, on vocabulary. The September group is not much better than this. Their best achievement is in vocabulary, where the girls rank 50 and the boys 51.

It appears that the September freshmen are less variable, but the differences in variability are not pronounced. In almost all cases the differences in means could be attributed to the error of the means.

The question naturally arises as to why a group which registers superiority in intelligence factors should show no superiority, and even some inferiority, in the factors of English ability. This question

TABLE II. COMPARISON OF JANUARY-FEBRUARY AND SEPTEMBER GROUPS USING SCORES ON THE COOPERATIVE ENGLISH TEST

	January-February group					September group					Reliability of differences			
	No.	Mean	Percentile rank	σ Mean	σ	No.	Mean	Percentile rank	σ Mean	σ	Actual diff.	σ Diff.	$\frac{D}{\sigma D}$	Chances in 100
USAGE														
Boys	117	51.63	33	± .94	10.15	96	48.40	22	± .80	7.80	3.23	1.23	2.63	99
Girls	53	56.11	51	±1.29	9.40	100	54.75	46	± .81	8.10	1.36	1.52	.89	82
Total	170	53.03	39	± .78	10.15	196	51.60	33	± .62	8.65	1.43	1.04	1.38	92
SPELLING														
Boys	117	49.28	32	± .92	10.00	96	50.10	35	± .96	9.35	.82	1.33	.62	73*
Girls	53	51.68	42	±1.41	10.25	100	52.90	48	±1.01	10.05	1.22	1.73	.71	76*
Total	170	50.03	35	± .78	10.15	196	51.50	41	± .70	9.80	1.47	1.05	1.40	92*
VOCABULARY														
Boys	117	55.48	43	± .86	9.35	96	57.17	51	± .88	8.60	1.69	1.23	1.37	91*
Girls	53	56.78	48	±1.39	10.10	100	57.05	50	± .91	9.10	.27	1.66	.16	56*
Total	170	55.88	45	± .74	9.60	196	57.11	50	± .63	8.85	1.23	.97	1.27	89*
TOTAL														
Boys	117	52.45	37	± .85	9.15	96	51.85	34	± .89	8.75	.60	1.23	.49	69
Girls	53	55.08	48	±1.21	8.80	100	55.15	49	± .83	8.30	.07	1.47	.05	50*
Total	170	53.26	40	± .70	9.15	196	53.53	41	± .60	8.45	.27	.92	.29	62*

* Differences in favor of the September group.

is largely unanswerable without further study, but a few logical deductions may be made.

In studying spelling ability of college students, Murray (10) found that:

> Direction of interests toward or away from literary studies strongly affects spelling. Interest in mathematics appears to exert an inhibitory influence.

The present emphasis on mathematics in the high school—a natural concomitant of preparation for war service—may have produced this "inhibitory influence" on both groups.

The factor of maturity may have something to do with this comparatively low English ability. It has already been mentioned that the January-February group contains a sizable number of accelerated people. As pointed out later in this study, the average age of this group is somewhat below normal.

A study of language arts achievement in the sixth grade in Indiana may throw some light on the question (3). This study brought out the fact that the sixth grade children were retarded, on the average, 1.4 years in language usage, 1.0 years in word meaning (corresponding to vocabulary), and 1.2 years in spelling. Another study, by Smith and Eaton, of the scores of university graduate students on the Cooperative English Test shows that these students were barely able to equal the standards set for high school seniors (13). All this indicates that English achievement is not up to par in Indiana. Whether this is due to amount of time spent in preparation, lack of emphasis on the subject matter, lack of teacher preparation, or other extraneous factors can only be determined by further investigation.

Sex Differences in Intelligence Ratings.—The constitutional dichotomy of humans is evident from birth, and these differences widen in scope through development, reaching highest maturity both in structure and function in adulthood (9). Since both groups of freshmen are very close to adulthood, we would expect to find some differences in test results due to sex. Table III shows comparisons between boys and girls of the January-February and September groups respectively on intelligence as measured by the Psychological Examination.

The September girls outrank the boys on the linguistic part, while the boys outrank the girls on both the quantitative part and the total. None of these differences, however, are particularly significant, the most significance (97 chances in 100) being shown by the boys on the quantitative part of the test. There is very little difference between sexes either in means or variability, although the girls tend to be a shade more variable. Percentiles vary from 40 (girls, quantitative) to 61 (girls, linguistic). It should be noted that the boys rank above the normal standard of 50 on all three parts of the examination.

In contrast to this, Table III shows that the January-February boys outrank the girls on all three divisions, the differences being most pronounced on the quantitative part, less pronounced on the total, and least on the language part. Differences in means range from

TABLE III. COMPARISON OF BOYS AND GIRLS OF THE SEPTEMBER AND THE JANUARY-FEBRUARY GROUPS USING SCORES ON THE ACE PSYCHOLOGICAL EXAMINATION

	Boys				Girls				Reliability of differences			
	Mean	Percentile rank	σ Mean	σ	Mean	Percentile rank	σ Mean	σ	Actual diff.	σ Diff.	$\frac{D}{\sigma D}$	Chances in 100
SEPTEMBER GROUP												
Quantitative	40.31	52	±1.33	12.10	36.85	40	±1.22	12.15	3.46	1.80	1.92	97
Linguistic	66.06	56	±1.31	12.88	67.70	61	±1.50	14.95	1.64	1.94	.85	80*
Total	107.19	58	±2.28	22.30	105.00	54	±2.34	23.40	2.19	3.27	.67	74
JANUARY-FEBRUARY GROUP			±									
Quantitative	46.41	73	± .82	8.85	43.40	64	±1.27	9.25	3.01	1.51	1.99	98
Linguistic	67.99	62	±1.38	14.95	67.95	62	±2.12	15.40	.04	2.53	.02	50
Total	114.03	69	±1.95	21.10	109.84	63	±3.06	22.30	4.19	3.63	1.15	87

* Differences in favor of the girls.

4.19 to .04. Again it appears that the girls are slightly more variable than the boys. Percentiles range from 62 to 73, a range which is about half that of the September group.

The apparent superiority is probably not an indication of general superiority of boys over girls. It is more likely due to the fact that selective factors in wartime tend to have more effect on boys than on girls.

Some of the differences may be due to the larger number of boys studied, but this factor could be argued either way.

Sex Differences in English Ratings.—It has been stated that girls tend to do better than boys in speech facility and vocabulary (6). Table IV shows evidence to corroborate this statement, as far as the September freshmen are concerned. These girls show a reliable advantage over the boys in English usage, and a nearly reliable advantage in spelling. The boys outrank the girls in vocabulary, but not significantly. On the totals the girls are definitely superior. The boys are slightly less variable than the girls except on the total. Percentiles show a range of from 22 to 51 for the boys, and of from 46 to 50 for the girls, the latter being far more consistent.

For the January-February group these same general trends hold. The girls outrank the boys in all parts of the test, showing rather significant advantages in all except vocabulary. The variability of these boys and girls is about the same, and what differences appear are not consistent. Percentiles range from 32 to 43 for boys, and from 42 to 51 for girls—ranges which are rather comparable within the areas they cover.

Summary and Conclusions.—The January-February (1943) group of 170 entering freshmen has been compared to a sample group of 196 September (1942) freshmen. Scores on the American Council Psychological Examination and the Cooperative English Test have been used as bases of comparison. The following conclusions are drawn:

1. The January-February freshmen are definitely superior to the September freshmen in intelligence as measured by the ACE Psychological Examination.
2. This superiority is much more pronounced in solving quantitative problems than in problems using linguistic abilities.
3. The superiority is probably due to (*a*) better guidance in wartime, (*b*) selectivity caused by war conditions, (*c*) effect of better training in the larger communities from whence students come, and (*d*) other extraneous factors.
4. There are no large differences in English aptitude between the two groups.
5. A paradox arises from the fact that the January-February group, which ranks significantly above the September group in intelligence factors, ranks below the latter in English factors except in English usage.
6. This may be attributable in part to (*a*) shifting of emphasis in high school from linguistic to quantitative subjects, and (*b*) lack of maturity in the January-February group.

TABLE IV. COMPARISON OF BOYS AND GIRLS OF THE SEPTEMBER AND THE JANUARY-FEBRUARY GROUPS, USING SCORES ON THE COOPERATIVE ENGLISH TEST

	Boys				Girls				Reliability of differences			
	Mean	Percentile rank	σ Mean	σ	Mean	Percentile rank	σ Mean	σ	Actual diff.	σ Diff.	$\frac{D}{\sigma D}$	Chances in 100
SEPTEMBER GROUP												
Usage	48.40	22	± .80	7.80	54.75	46	± .81	8.10	6.35	1.14	5.57	100*
Spelling	50.10	35	± .96	9.35	52.90	48	±1.01	10.05	2.80	1.39	2.01	98*
Vocabulary	57.17	51	± .88	8.60	57.05	50	± .91	9.10	.12	1.27	.09	54
Total	51.85	34	± .89	8.75	55.15	49	± .83	8.30	3.30	1.22	2.70	99.7*
JANUARY-FEBRUARY GROUP												
Usage	51.63	33	± .94	10.15	56.11	51	±1.29	9.40	4.48	1.60	2.80	99.7*
Spelling	49.28	32	± .92	10.00	51.68	42	±1.41	10.25	2.40	1.68	1.43	93*
Vocabulary	55.48	43	± .86	9.35	56.78	48	±1.39	10.10	1.30	1.63	.80	79*
Total	52.45	37	± .85	9.15	55.08	48	±1.21	8.80	2.60	1.48	1.76	96*

* Differences in favor of the girls.

7. The January-February boys rank higher than the girls on intelligence factors, a fact which is not so evident in the September group.
8. The differences in favor of the boys are probably due to the fact that the selectivity factors conditioned by war operate more intensively on boys than on girls.
9. The English abilities of the girls are superior to those of the boys in both groups.

ANALYSIS OF PERSONAL DATA OF THE JANUARY-FEBRUARY FRESHMEN

Each freshman who enters Indiana University is required to submit an application for admission. From these applications the following items have been selected as being of interest in an analysis of the class:

1. Age
2. High school from which graduated
3. Father's occupation
4. Vocational preference
5. Size of family
6. Physical defects

Data for each of the above items have been classified into convenient categories. Distribution tables have been made for boys and girls separately, and in most cases percentages have been computed.

Age.—Table V shows the distribution of age for the January-February freshmen. It will be noted that 68 per cent of the boys and 45 per cent of the girls are between 17 and 18 years of age, while only 5 per cent of the boys and 4 per cent of the girls are under 17. This is slightly under the normal age of entering college freshmen. Of the total, 85 per cent are from 17 to 19 years of age.

TABLE V. AGE DISTRIBUTION OF JANUARY-FEBRUARY FRESHMEN

Age range	Boys		Girls		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
16-0 to 16-11	6	5	2	4	8	4
17-0 to 17-11	79	68	24	45	103	60
18-0 to 18-11	24	20	19	36	43	25
19-0 to 19-11	4	3	6	11	10	6
20-0 to 20-11	2	2	1	2	3	2
21-0 to 21-11	1	1	0	0	1	1
22-0 to 22-11	0	0	1	2	1	1
27-0 to 27-11	1	1	0	0	1	1
Total	117	100	53	100	170	100
Range	16-1 to 27-2		16-3 to 22-0		16-1 to 27-2	
Average age	17-11		18-0		17-11	

The range of boys' ages is from 16 to 21 years, except for one case which falls at the 27-year level. The girls' range is from 16 to 22, an increase of one year over the boys' range.

The average boy was 17 years, 11 months old at the time of entrance, and the average girl was 18 years, 0 months. The slight difference is probably due to the fact that more emphasis is placed on acceleration of boys than on that of girls under war conditions. Neither average deviates much from what might be expected of freshmen entering under normal conditions, although this group is a little younger than average.

Geographic Distribution of High Schools.—There are 153 of the January-February group who have listed themselves as having attended or graduated from Indiana high schools. The remaining 17 either have not listed a high school or are from outside the state.

Although the high schools attended by these students are well distributed throughout the state, most of the students come from the more heavily populated centers, with the state capital, Indianapolis, leading the list with 32 students represented. The majority of students come from city schools.

Table VI shows the number of counties having various numbers of students represented. Forty-one counties are not represented; 23 are represented by 1 student each; 12 by 2. From here on the number of counties decreases as the number of students represented increases.

TABLE VI. DISTRIBUTION OF THE NUMBER OF COUNTIES HAVING A CERTAIN NUMBER OF STUDENTS ENROLLED AT INDIANA UNIVERSITY IN THE JANUARY-FEBRUARY CLASS

Number of students per county	Counties having various numbers of student representation		Students from counties with various numbers of student representation	
	Number	Per cent	Number	Per cent
0.....	41	45	0	0
1.....	23	25	23	15
2.....	12	13	24	16
3.....	5	6	15	10
4.....	2	2	8	5
5.....	3	3	15	10
6.....	2	2	12	8
7.....	1	1	7	4
8.....	1	1	8	5
9.....	1	1	9	6
32.....	1	1	32	21
Total	92	100	153	100

Occupations of Fathers.—The fathers of the January-February freshmen show a rather wide range of callings. Table VII shows a distribution of these parental occupations for both boys and girls, with the percentage in each occupation.

Salesman heads the list, with 14 per cent of the total accounted

for, and merchant is next with 12 per cent. Of the 11 per cent listing the medical profession, nine boys and five girls list the occupation of their fathers as physician; two boys and one girl, as dentist; one girl, as veterinarian; one boy, as optometrist; and one boy, as pharmacologist.

Eleven per cent either list their fathers as deceased or have failed to list any occupation.

The 11 per cent of pupils classifying their father's occupation as industry include: mechanic or electrician, six boys and three girls; factory worker, three boys and two girls; defense worker, three boys; and stone cutter, one boy and one girl.

TABLE VII. DISTRIBUTION OF FATHERS' OCCUPATIONS OF JANUARY-FEBRUARY FRESHMEN

	Boys		Girls		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Salesman	18	15	5	9	23	14
Merchant	13	11	7	13	20	12
Medical man	12	10	7	13	19	11
Not reported or deceased	10	9	9	17	19	11
Industrial worker	13	11	6	11	19	11
Executive	10	9	7	13	17	10
Educator	9	8	2	4	11	6
Public service worker	6	5	3	6	9	5
Farmer	4	3	2	4	6	3
Engineer	4	3	1	2	5	3
Lawyer	3	3	2	4	5	3
Railroader	4	3	0	0	4	2
Auditor and accountant	3	3	0	0	3	2
Newspaper man	3	3	0	0	3	2
Minister	1	1	2	4	3	2
Army officer	2	2	0	0	2	1
Undertaker	1	1	0	0	1	1
Watchman	1	1	0	0	1	1
Total	117	100	53	100	170	100

Ten per cent list their fathers as executives.

In education, one boy's father is a school principal; seven are teachers in the public schools; one is a librarian. One girl lists her father as a college professor; another as a teacher.

Of the fathers classified under public service, two of the boys' fathers are listed as policemen; two are in mail service; and two are in politics. One girl's father is a Red Cross director, while two are politicians.

Only four boys and two girls have fathers who are farmers, and four boys and one girl have fathers who are engineers.

Others list their fathers in the following occupations: lawyer, three boys and two girls; railroader, four boys; auditor and accountant, three boys; newspaper man, three boys; minister, one boy and two girls; army officer, two boys; undertaker and watchman, one boy each.

Vocational Preferences.—Table VIII shows the distribution of vocational preferences of the January-February freshmen.

Medicine heads the list, accounting for the preferences of 36 per cent of the boys and 15 per cent of the girls. Indiana University always has had a large number of entering students who elect the medical course. This percentage is, therefore, not abnormally high. It may be supposed that a few of these have been conditioned in their decisions by the chances of deferment from active military service. The fact that 15 per cent of the girls elect medicine may indicate a trend on the part of girls to enter this profession.

The 22 per cent who have elected business and commerce include the following: 16 boys and six girls, business; one boy and four girls, commerce; three girls, secretarial course; and six boys and one girl, accounting.

TABLE VIII. DISTRIBUTION OF VOCATIONAL PREFERENCES OF JANUARY-FEBRUARY FRESHMEN

Elected courses	Boys		Girls		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Medicine	43	36	8	15	51	30
Business and commerce	23	19	14	26	37	22
No preference listed	28	24	7	13	35	21
Fine arts	1	1	9	17	10	6
Education	1	1	6	11	7	4
Law	6	5	1	2	7	4
Engineering	6	5	0	0	6	3
Journalism	2	2	4	8	6	3
Science	3	3	1	2	4	2
Aeronautics	2	2	0	0	2	1
Sociology	1	1	1	2	2	1
Languages	0	0	1	2	1	1
Personnel	0	0	1	2	1	1
Physical education	1	1	0	0	1	1
Total	117	100	53	100	170	100

The failure of only 21 per cent to list a preference emphasizes the fact that most of these people have a definite purpose in mind in regard to higher education.

The remaining subjects have attracted relatively few numbers of students, especially of the male sex. Of the girls, 17 per cent and 11 per cent have elected respectively fine arts (including music, dramatics, and commercial art) and education. The only other sizable percentage is in journalism, for which 8 per cent of the girls show preference.

To one who is not acquainted with the dichotomous arrangement of state supported universities in Indiana, it should be pointed out that technical courses constitute the principal curricula of Purdue University, the sister institution of Indiana University. It is therefore not unusual that few Indiana University freshmen elect courses

in the more technological fields, since the offerings in these fields are strictly limited.

Size of Families.—Table IX shows the number of children in the families from which the January-February freshmen come.

The number of children in each family ranges from one to seven. The average family contains 2.67 children.

TABLE IX. SIZE OF FAMILIES OF THE JANUARY-FEBRUARY FRESHMEN IN TERMS OF THE NUMBER OF CHILDREN

Number of children	Freshmen reporting	
	Number	Per cent
1	30	18
2	62	37
3	41	24
4	20	12
5	9	5
6	4	2
7	4	2
Total	170	100

Physical Defects.—Table X shows the distribution of physical defects of the January-February freshmen. It will be noted that 10 per cent of the boys and 9 per cent of the girls have listed some kind of defect.

Eye defects predominate, accounting for 7 per cent of the boys and 4 per cent of the girls. The small number of other defects are distributed as follows: one boy each lists respiratory disease, arm injury, hip injury, and loss of finger; one girl each lists respiratory disease, bad knees, and weak foot. The list of physical defects does not seem unusually large nor abnormally distributed.

TABLE X. DISTRIBUTION OF PHYSICAL DEFECTS OF JANUARY-FEBRUARY FRESHMEN

Defects	Boys		Girls		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Eyes	8	7	2	4	10	6
Respiratory disease	1	1	1	2	2	1
Arm injury	1	1	0	0	1	⅗
Bad knees	0	0	1	2	1	⅗
Hip injury	1	1	0	0	1	⅗
Loss of right finger	1	1	0	0	1	⅗
Weak foot	0	0	1	2	1	⅗
Number listing defects	12	10	5	9	17	10
Number listing no defects	105	90	48	91	153	90
Total	117	100	53	100	170	100

Summary and Conclusions.—Personal data for the January-February freshmen have been taken from their admission applications. These data have been analyzed and the following conclusions drawn:

1. Neither the range nor the average age at entrance deviates much from normal, but the group as a whole ranges a little younger than an average group.
2. The group is made up of students from 50 of the 92 counties.
3. One highly noticeable characteristic is the fact that most of the students come from the more populated communities, only a small number being listed from rural high schools. This is also verified by the fact that only 3 per cent list farming as the father's occupation.
4. The distribution of fathers' occupations shows a mild but by no means consistent trend toward the so-called higher classification. Sixty-nine per cent fall in the categories of salesmen, medical men, merchants, industrial workers, executives, educators, and public service workers. With 11 per cent not reporting or deceased, this leaves only 20 per cent in other groups.
5. Thirty per cent of the freshmen have elected a course in medicine; 22 per cent, in business and commercial courses. Together with 21 per cent who have listed no preference, these divisions account for the vocational preference of 73 per cent of the entire group. This may indicate a trend away from the so-called cultural curricula in wartime.
6. A trend is indicated in the fact that 15 per cent of the girls have elected medicine, although the small number of girls in the group would preclude any definite conclusions.
7. The fact that only 21 per cent have failed to list perferences shows that the group as a whole is rather resolute of purpose.
8. The number of children in the families of the January-February freshmen ranges from one to seven, the average being 2.67.
9. Ten per cent of the boys and 9 per cent of the girls list physical defects. The distribution of these defects is not unusual, either in numbers or kinds.

A COMPARISON OF THE PART OF THE GROUP WHICH WAS ACCELERATED WITH THE REMAINDER OF THE GROUP WHICH ENTERED WITH NORMAL PREREQUISITES

Sources of Data.—In order to study the accelerated part of the January-February freshman group in relation to the non-accelerated part, data have been secured from the admission applications, high school transcripts, scores on the University orientation tests, and records of achievement. The following items have been chosen as bases of comparison:

1. High school status
2. Age
3. Vocational preference
4. ACE Psychological Examination scores
5. Cooperative English Test scores
6. Average high school marks

7. First semester achievement
8. Comparison of matched groups

Procedures.—The data were classified and tables made. Because of the relatively few girls included in the accelerated group, the subdivision by sex has been omitted in comparisons.

Statistical treatment involves measures of central tendency, of variability, and of reliability of differences. The statistical methods used are the same as those described on page 7 of this study.

High School Status.—According to Table XI, the January-February freshmen had three degrees of high school status when they entered the University. The majority of them had already received diplomas. A substantial percentage lacked from a few days to a few weeks of graduating. Still another part needed at least one semester before graduating.

TABLE XI. DISTRIBUTION OF THE HIGH SCHOOL STATUS OF THE JANUARY-FEBRUARY FRESHMEN AT THE TIME OF MATRICULATION

Status of students	Boys		Girls		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Those who had graduated from high school	61	52	35	66	96	56
Those who lacked a few days to a few weeks of school for graduation	25	21	10	19	35	21
Those who lacked a full semester for graduation	31	27	8	15	39	23
Total	117	100	53	100	170	100

Those needing a semester to graduate have been studied and compared with the remainder of the class, which includes those who lacked only a few days or weeks and those who had already graduated. Those who lacked a semester total 39 of the original 170, or 23 per cent. Twenty-one per cent lacked from a few days to a few weeks, and 56 per cent had already graduated from high school. These are not very large groups for comparative purposes, but it is believed that the differences at least indicate certain trends for future consideration.

In the remaining pages of this comparison the people who lack at least a semester will be referred to as the *accelerated group.* The others will be called the *non-accelerated group.*

There are more boys than girls in the accelerated group, 31 and 8 respectively, but the entire class also contains more boys than girls. The ratio of boys to girls in the accelerated group is about 4:1; in the non-accelerated group, about 2:1; in the entire class, about 3:1.

Age.—Table XII gives a distribution of ages, which may be used in comparing the accelerated and non-accelerated students.

The average age of the accelerated group is 17 years, 7 months, and of the non-accelerated group, 17 years, 11 months. Both of these averages are computed as of the date of matriculation. The difference of four months in the averages is exactly what might be expected under existing conditions.

In the accelerated group, ages range from 16 to 19 years. In general, the non-accelerated group covers the same age range, although there are a few scattered cases ranging to higher levels.

TABLE XII. DISTRIBUTION OF AGES OF THE ACCELERATED AND NON-ACCELERATED GROUPS

Age limits	Accelerated group		Non-accelerated group	
	Number	Per cent	Number	Per cent
16-0 to 16-11	4	10	4	3
17-0 to 17-11	28	72	75	57
18-0 to 18-11	6	15	37	28
19-0 to 19-11	1	3	9	7
20-0 to 20-11	0	0	3	2
21-0 to 21-11	0	0	1	1
22-0 to 22-11	0	0	1	1
27-0 to 27-11	0	0	1	1
Total	39	100	131	100

Seventy-two per cent of the accelerated people are in the 17 years of age group, while 57 per cent of the non-accelerated group fall in this class. Of the accelerated group, 15 per cent are 18 years of age; of the non-accelerated group, 28 per cent. The differences in percentage in these two age classes, together with the few scattered cases of non-accelerated students falling from 20 to 27 years of age, account for the differences in average between the two groups.

It is interesting to note that in each group four persons are only 16 years of age.

Vocational Preference.—It has been found that the more intelligent students make fewer errors in estimation of their interests, but that the correlation between affirmed interests and tested interests is not large enough to be of predictive value (2). Since the entire class of January-February freshmen shows above-average intelligence as measured by their scores on the ACE Psychological Examination, we may assume that they will be rather reliable in their vocational preferences. However, the fact should not be overlooked that these vocational preferences are perhaps somewhat influenced by wartime conditions as well as by the offerings of the University.

TABLE XIII. DISTRIBUTION OF VOCATIONAL PREFERENCES OF THE ACCELERATED AND NON-ACCELERATED GROUPS

Elected courses	Accelerated group		Non-accelerated group	
	Number	Per cent	Number	Per cent
Medicine	15	38	36	27
Business and commerce	6	15	31	24
No preference	8	20	27	21
Fine arts	3	8	7	5
Education	1	3	6	5
Law	0	0	7	5
Engineering	2	5	4	3
Journalism	2	5	4	3
Science	1	3	3	2
Aeronautics	0	0	2	1½
Sociology	0	0	2	1½
Languages	0	0	1	1
Personnel	1	3	0	0
Physical education	0	0	1	1
Total	39	100	131	100

Table XIII may be used to compare the accelerated and non-accelerated groups with respect to vocational preferences. The following differences in percentages may be noted: Of the accelerated group, 9 per cent more than of the non-accelerated group have chosen medicine; 9 per cent fewer have chosen business and commerce; and none of the accelerated group have chosen law, which has been selected by 7 per cent of the non-accelerated group. About the same percentage of each group list no preference. Other differences in percentages are insignificant.

ACE Psychological Examination Scores.—Table XIV shows the reliability of differences in mean scores of the two groups on the Psychological Examination and the Cooperative English Test.

It is apparent that there is little difference in linguistic ability, the mean difference being only .60, in favor of the accelerated group, with a reliability of difference of only 60 chances in 100.

On the quantitative part of the test, however, the accelerated group shows rather definite superiority. The chances are 96 in 100 that the difference in means of 2.70 is a reliable difference.

The totals, obtained by summing the individual scores on the two parts, show a fairly reliable difference, this difference being somewhat less reliable than that on the quantitative part of the test but substantially higher than that on the linguistic part.

The non-accelerated group appears to be somewhat more variable than the accelerated group on all parts of the Psychological Examination. However, when these differences in variability are tested, they are found not to be particularly significant. The chances of error which attend all statistical treatment tend to minimize the importance of attaching much weight to any of the differences noted above, especially when one considers the relatively small number of cases involved.

TABLE XIV. THE RELIABILITY OF DIFFERENCES IN MEANS BETWEEN THE ACCELERATED AND NON-ACCELERATED GROUPS USING SCORES ON THE ACE PSYCHOLOGICAL EXAMINATION AND THE COOPERATIVE ENGLISH TEST

Test	Accelerated group				Non-accelerated group				Reliability of differences			
	Number	Mean	σ	σ Mean	Number	Mean	σ	σ Mean	Actual diff.	σ Diff.	$\frac{D}{\sigma D}$	Chances in 100
ACE PSYCHOLOGICAL EXAMINATION												
Quantitative	39	47.55	8.10	±1.30	131	44.85	9.35	± .82	2.70	1.54	1.75	96
Linguistic	39	68.30	14.15	±2.27	131	67.90	15.20	±1.33	.60	2.63	.23	60
Total	39	116.10	20.10	±3.22	131	112.00	22.00	±1.92	4.10	3.75	1.09	86
COOPERATIVE ENGLISH TEST												
Usage	39	54.55	10.55	±1.69	131	52.60	9.90	± .86	1.95	1.90	1.03	85
Spelling	39	53.25	10.90	±1.75	131	49.35	9.95	± .87	3.90	1.95	2.00	98
Vocabulary	39	57.60	8.63	±1.38	131	55.55	9.70	± .85	2.15	1.62	1.33	91
Total	39	55.05	9.45	±1.51	131	52.75	8.90	± .78	2.30	1.70	1.35	91

Cooperative English Test Scores.—On the Cooperative English Test the means of the accelerated group are higher than are those of the non-accelerated group on all parts of the test, and range from 1.95 points in English usage to 3.90 in spelling. The most reliable difference is found in spelling, where the chances of superiority of the accelerated over the non-accelerated group are 98 in 100. The lowest reliability of difference in means is in English usage (85 in 100). It appears that the accelerated group will rate higher than the non-accelerated group about 91 times in 100 on vocabulary and total.

A reversal of this is noticed in connection with the differences in variability. The non-accelerated group shows less variability than does the accelerated group in all parts of the test except vocabulary. However, when the reliabilities of differences are tested, they are not very high in any case.

Average High School Marks.—The wide differences in standards for grading in various high schools make it rather difficult to draw any conclusions from this source of information. In writing about the subject, Odell states that "a number of studies . . . show very noticeable differences among teachers, departments, and schools in their distributions of marks even when they are employing what is supposed to be the same system" (11).

Table XV shows a distribution of average high school marks for both the accelerated and non-accelerated groups.

The means for each group have been computed by assigning arbitrary numerical values to the various categories of marks.

TABLE XV. DISTRIBUTION OF AVERAGE HIGH SCHOOL MARKS FOR THE ACCELERATED AND NON-ACCELERATED GROUPS

Average	Numerical value	Accelerated group		Non-accelerated group	
		Number	Per cent	Number	Per cent
A	95-100	3	8	17	13
A-B	90-94	13	33	41	31
B	85-89	10	26	31	24
B-C	80-84	6	15	26	20
C	75-79	7	18	16	12
Total		39	100	131	100
Mean		86.85		87.65	
σ		1.23		1.23	

An examination of the table shows that there is only a slight difference in average high school marks for the two groups, but the difference is in favor of the non-accelerated group.

Elsewhere in this study it is stated that the accelerated people have been accepted by the University upon the recommendation of the high school principals. All the data thus far indicate that these principals are to be commended for their good judgment. It remains

to verify this statement by an examination of the achievement of the groups.

First Semester Achievement.—The grades of the January-February freshmen have been tabulated from the records of the University Registrar. Letter marks, together with credit points, have been used to determine the grade-point ratio for each student. Each hour of credit receives the following points for various grade marks: A = 3, B = 2, C = 1, D = 0, F = —1.

The ratios are actually determined by dividing number of credit points by the number of hours enrolled. For convenience in writing, the decimal points have been left out; i.e., 1.15 = 115.

Of the 131 original enrollees in the non-accelerated group, seven withdrew for various causes during the semester. Of the original 39 accelerated, two withdrew.

Table XVI shows a distribution of the grade-point ratios of the accelerated and non-accelerated groups, using first semester achievement.

In order to estimate the average achievement of each individual from these grade-point ratios, it is necessary to translate the ratios into letter marks. The following arbitrary values may be assigned for this purpose:

A = 270 — 300
A-B= 250 — 269
B = 200 — 249
B-C= 170 — 199
C = 100 — 169
C-D= 70 — 99
D = 00 — 69
F =-100 — -01

It must be understood that these values are approximate, and at best are only estimations.

From the table it is found that the average or mean of the accelerated group is 115, or "C", if we translate this ratio into a letter mark. The mean of the non-accelerated group is 94, or about "C—".

The standard deviation of 80 for the accelerated group and of 93 for the non-accelerated group shows the latter group to be more variable than the former.

The distribution of ratios for each group appears to be fairly normal.

Although it must be reiterated that the small number of cases makes it unwise to do much generalizing, these data show some implications. The fact that the accelerated group is a little better than the non-accelerated group on intelligence and English factors as measured by standardized tests is somewhat balanced by the fact that the non-accelerated group has better high school averages than the accelerated. It seems logical, therefore, to assume either that the groups are about equal in ability or that the high school marks are in error.

TABLE XVI. DISTRIBUTION OF GRADE-POINT RATIOS FOR THE ACCELERATED AND NON-ACCELERATED GROUPS ON FIRST SEMESTER ACHIEVEMENT

Step interval	Accelerated group		Non-accelerated group	
	Number	Per cent	Number	Per cent
270 - 300	2	5¼	2	2
240 - 269	1	3	6	5
210 - 239	2	5¼	9	7
180 - 209	1	3	10	8
150 - 179	6	16	10	8
120 - 149	5	14	12	9
90 - 119	6	16	113	10
60 - 89	6	16	19	15
30 - 59	3	8	9	7
00 - 29	2	5¼	15	12
—30 - —01	2	5¼	10	8
—31 - —60	0	0	4	3
Total	37	100	131	100
Mean grade-point ratio	115		94	
σ	80		93	

If the groups are equal in ability, the fact that the accelerated group excels the non-accelerated in achievement indicates that these students have not been handicapped by missing the last semester of high school. If the group is typical, we can assume that more high school students might profit by the same type of acceleration. The findings also verify the fact that the high school principals have shown excellent judgment in selecting those students who might profit by acceleration.

Comparison of Matched Groups.—It may be argued, and rightly, that to compare an accelerated group of students with any average unaccelerated group is not necessarily a valid procedure, since any acceleration infers a selective process.

Although the data show that there is a large amount of homogeneity in the January-February group, it seems expedient that a finer instrument of measurement be found. Accordingly, the members of the accelerated group have been matched with an equal number of unaccelerated students, using total scores on the Psychological Examination. Although it is not possible to match each person exactly, because of the insufficient number of cases, a fairly accurate matching has been obtained and the small differences allowed are well distributed.

Table XVII shows the distribution of ACE scores and grade-point ratios for the accelerated and matched groups.

On the ACE the accelerated group shows a mean advantage of .81, which indicates that the chances are only 57 in 100 that the true differences in the means of the groups are greater than zero. Since 57 chances in 100 are little better than a toss-up, we may assume that the two groups are fairly well matched.

TABLE XVII. DISTRIBUTION OF ACE SCORES AND GRADE-POINT RATIOS FOR THE ACCELERATED GROUP AND A MATCHED GROUP OF THE SAME NUMBER OF NON-ACCELERATED STUDENTS

Step interval	ACE scores		Step interval	Grade-point ratios	
	Accelerated group	Matched group		Accelerated group	Matched group
148 - ---	4	2	270 - 300....	2	1
138 - 147	1	4	240 - 269....	1	2
128 - 137	3	2	210 - 239....	2	3
118 - 127	12	10	180 - 209....	1	5
108 - 117	4	5	150 - 179....	6	3
98 - 107	8	9	120 - 149....	5	4
88 - 97	2	2	90 - 119....	6	4
78 - 87	1	2	60 - 89....	6	6
68 - 77	2	1	30 - 59....	3	2
			00 - 29....	2	4
			—30 - —01....	2	3
			—60 - —31....	0	0
			- - - —61....	1	0
N =	37	37	N =	37	37
M =	116.28	115.47	M =	115	119.5
σ =	20.00	19.00	σ =	80	83
σM =	3.29	3.12	σM =	13.15	13.64
σ(M1-M2) =	4.58		σ(M1-M2) =	16.09	
D =	.81		D =	4.5	
$\frac{D}{\sigma D}$ =	.18		$\frac{D}{\sigma D}$ =	.28	
Chances of reliable difference in means = 57 in 100			Chances of reliable difference in means = 61 in 100		

When the achievement of the two groups is tabulated by using grade-point ratios, a difference in means of 4.5 points is obtained. This difference is in favor of the unaccelerated group. In working through these results for reliability of differences, it is found that the chances are 61 in 100 that the true difference is greater than zero. Thus this difference is also without much significance.

If the arbitrary values for grade-point ratios are re-examined, it is apparent that it takes an average of 40 points or more to proceed from one letter category to another, and to raise a grade one whole letter mark requires on the average about 75 grade points. We can easily see that the obtained difference of 4.5 between these two groups is not very important.

It would appear from all this that, as far as this group is concerned, the process of acceleration has not led to any noticeable degree of lowered achievement. Even if the obtained difference is a true difference, which we have shown is unlikely, we might infer that the time saved by those accelerated would more than counterbalance the small loss in achievement.

Summary and Conclusions.—Of the 170 entering January-February freshmen, 39, or 23 per cent, lacked a full semester of graduating from high school when they entered the University. Since this accelerated portion of the class contains only a few girls, they have been studied as a group, without regard to sex differences. Comparisons have been made between the accelerated and non-accelerated groups, using the following bases: age, vocational preference, ACE Psychological Examination scores, Cooperative English Test scores, average high school marks, first semester achievement, and matched groups. Data have been classified and statistically treated to find central tendencies, variability, and reliability of differences. The following conclusions have been drawn:

1. A difference of four months is noted in the average ages of the accelerated and non-accelerated groups.
2. Since all members of the accelerated group lack one semester of graduating from high school, this difference is normal.
3. No very substantial differences are noted in the vocational preferences of the groups. More of the accelerated group tend to elect medicine, while more of the non-accelerated group want to study business and commercial courses. About the same percentage of each group list no preference.
4. The accelerated group shows some superiority over the non-accelerated in scores on the ACE Psychological Examination, especially the quantitative part of this test. The reliability of differences on this part of the test show chances of superiority of 96 in 100 in favor of the accelerated group.
5. The variability of the two groups shows the same trends.
6. The small number of cases and the chances of error involved in various types of statistical treatment tend to minimize the importance of the differences in intelligence factors found between the groups.
7. On the Cooperative English Test the accelerated students reiterate a trend toward superiority, although no substantial differences occur.
8. The accelerated group seems to be best in spelling and least superior in English usage.
9. The non-accelerated group shows less variability than the accelerated in each English factor except vocabulary.
10. Again it should be pointed out that none of the differences are particularly significant, especially when the smallness of the group is considered.
11. Only slight differences are found in the average high school marks of each group.
12. The differences that appear in the means of the groups show a slight advantage in favor of the non-accelerated people.
13. The variability of the groups in average high school marks shows no difference.
14. The accelerated group shows better average University achievement than does the non-accelerated group, and less variability.
15. Although the number of cases is small, if this accelerated group

is typical we can infer that more high school students might profit by such acceleration.

16. Since the accelerated students have been individually recommended by their high school principals, these principals deserve commendation for their excellent judgment.
17. A more accurate comparison, obtained by matching each accelerated case with an unaccelerated case by means of ACE scores, still shows differences which are not significant.
18. A summary of the data implies that the accelerated group has not been handicapped by missing the last semester of high school.
19. If there is a true difference in the achievement of the two groups, which appears unlikely, the small difference has been more than justified by the time saved in the acceleration.

ANALYSIS OF RELATIONSHIPS INVOLVING THE JANUARY-FEBRUARY FRESHMEN, AND PREDICTION OF ACHIEVEMENT FOR A SIMILAR GROUP

In all statistical treatment involving relationships, the reliability of obtained measures of relationship varies directly with the number of cases; that is to say, the greater the number of cases, the more likely the obtained correlation coefficients will approximate the true measure of relationship. In the present study it would seem desirable to show separately the relationships involving the accelerated and unaccelerated groups, but it is unlikely that a very valid comparison could be drawn from this, owing to the small number of accelerated students in the class.

The apparent differences between boys and girls, evidenced throughout the study, point to the advisability of studying the sexes separately. It should be noted that the number of girls, 53, is not large enough for best results. The 117 boys constitute a better size group, but even this group is not as large as is desirable. However, as we have pointed out, these groups are the first of their kind to enter the University. It is hoped that any degree of unreliability in obtained results will be corrected as more groups of the same type are available for study.

Procedures.—Data used in this part of the study consist of (*a*) grade-point ratios, (*b*) average high school marks, (*c*) scores on various parts of the Cooperative English Test, (*d*) English and mathematics achievement, and (*e*) scores on various parts of the ACE Psychological Examination. The calculation of means and standard deviations on most of these data has been discussed earlier in the study and will not be repeated in this section. Scattergrams have been constructed, from which the correlations of the various items have been computed.

In order to determine the coefficients of correlation involving ratios and test scores, Garrett's formula 49 (5, page 270) has been used.

In all correlations where one of the variables is measured in letter marks, Holzinger's formula 116 (7, page 261) has been used.

The formulas and equations used in prediction will be discussed with the results listed in that part of the study.

Obtained Relationships.—Table XVIII shows the obtained relationships between the various items involving the January-February freshmen. It will be noted that the correlations of most of the variables have been computed for the combined group as well as for boys and girls separately.

The highest correlation for boys is .74 ± S.D. .04, between the Cooperative English Test scores and the Psychological linguistic scores. This result, coupled with the fact that the Cooperative English Test has been temporarily displaced by another in the University orientation program, has prompted the exclusion of this English test from later attempts at prediction.

The lowest correlation exists between the ACE and spelling scores. This result, .13 ± .09, indicates that about 7 times in 100 we may expect a negative correlation of these boys on the items mentioned. This also indicates, if this group is typical, that spelling ability is not very dependent upon the factors of mental ability measured by the ACE test.

Taken collectively, higher correlations have been obtained between the Cooperative English Test total scores and those on the two parts of the Psychological Examination (.47 and .74) than between the Psychological Examination total scores and those on the three parts of the Cooperative English Test (.42, .13, and .66).

TABLE XVIII. OBTAINED RELATIONSHIPS BETWEEN VARIOUS ITEMS INVOLVING THE JANUARY-FEBRUARY FRESHMEN

Items		Boys			Girls			Total		
x	y	r	σ_r	r^2	r	σ_r	r^2	r	σ_r	r^2
CE	ACE	.63	±.06	.40	.76	±.06	.58	.70	±.04	.49
CE	ACE-Q	.47	±.07	.22	.62	±.08	.38	.48	±.06	.23
CE	ACE-L	.74	±.04	.55	.73	±.06	.53	.72	±.04	.52
CE	EA							.50	±.06	.25
CE	AHSM	.38	±.08	.14	.43	±.11	.18	.40	±.06	.16
ACE	CE-U	.42	±.08	.18	.72	±.07	.52	.58	±.05	.34
ACE	CE-S	.13	±.09	.02	.47	±.11	.22	.25	±.07	.06
ACE	CE-V	.66	±.05	.44	.72	±.07	.52	.67	±.04	.45
ACE-Q	MA							.43	±.12	.18
ACE-L	EA							.39	±.07	.15
ACE	AHSM	.40	±.08	.16	.53	±.10	.28	.43	±.06	.18
ACE-Q	ACE-L	.59	±.06	.35	.60	±.09	.36			
AHSM	ACE-Q	.36	±.08	.13	.26	±.13	.07			
AHSM	ACE-L	.34	±.08	.12	.35	±.12	.12			
GPR	ACE-Q	.43	±.08	.18	.28	±.13	.08			
GPR	ACE-L	.56	±.07	.31	.44	±.11	.19			
GPR	CE	.49	±.07	.24	.56	±.09	.31			
GPR	AHSM	.53	±.07	.28	.47	±.11	.22			

CE — Cooperative English Test
CE-U — English usage
CE-S — Spelling
CE-V — Vocabulary

ACE — ACE Psychological Examination
ACE-Q — Quantitative part
ACE-L — Linguistic part

EA — English achievement
MA — Mathematics achievement

AHSM — Average high school mark
GPR — Grade-point ratio

The average high school marks of the boys correlate .40 with their scores on the ACE. By comparison, the average marks show a relationship of .38 with Cooperative English Test scores.

College achievement, as indicated by grade-point ratios, shows an r of .49 with Cooperative English Test scores, and an r of .43 and .56 respectively when correlated with the quantitative and linguistic parts of the ACE.

The correlation between the average high school marks and general college achievement of these boys is .53 ± .07. This agrees rather favorably with a median coefficient of .55, computed by Segal (12), who used findings of 23 investigators. However, this median coefficient is taken from data involving combinations of both sexes. Two studies from this group, reporting men separately, both list coefficients of .45.

When general college achievement is used as the item to be predicted, it appears that for the boys the best predictive item of the four is the linguistic part of the ACE, while the quantitative part of this test gives the most inferior prediction. The average high school mark ranks only a little under the linguistic part of the ACE, while the Cooperative English Test is still somewhat lower in the scale.

The standard errors of the obtained correlation coefficients are listed in Table XVIII. To one who is accustomed to interpreting probable errors rather than standard errors, it should be pointed out that each standard error is approximately one and one half times the size of the probable error of the same measure. The formula used for computing the standard error of the coefficient of correlation is $\sigma_r = \frac{1-r^2}{\sqrt{N}}$ (5, page 280). It is obvious that the size of the σr is conditioned by (1) the size of the group used in the correlation, and (2) the size of the obtained correlation coefficient. Since the data of this study are based upon a rather small number of cases, the standard errors of obtained r's are large.

As has been said, the highest coefficient of correlation for boys is .74 ± .04 on the Cooperative English Test and the ACE linguistic scores. Thus we can say that the chances are 68 in 100 that the real correlation coefficient falls between .70 and .78 (±1 S.D.), or, putting it another way, the obtained r on these two tests and for this group will be between .70 and .78 about 68 per cent of the time. We may be practically sure that the correlation coefficient will always fall within the limits .62 to .86 (± 3 S.D.'s).

By the same method, the lowest coefficient found for boys (.13 on ACE and spelling) may go as low as —.14 (3 x S.D. —.09). This is the only coefficient found for boys which may be negative, as all the other items show a positive relationship.

Table XVIII also shows r^2 for the various combinations of items. The square of an r gives the ratio of variance in either variable which is attributable to the influence of the other. This may also be thought of as the proportion of one variable which is overlapped by the elements of the other. According to this table, 55 per cent of what the

ACE linguistic test measures in the January-February boys is also measured by the Cooperative English Test, and vice versa. This represents the highest ratio found for the group, while the lowest is .02.

The highest correlation coefficient obtained for girls is .76 ± .06, from scores on the Cooperative English Test and the ACE Psychological Examination. If this group of girls is representative of similar groups, the chances are 68 in 100 that correlations of these items for similar groups will fall between .70 and .82 (± 1 S.D.), and the true correlation will fall somewhere in the limits .58 to .94.

The lowest coefficient obtained for this group is .26 ± .13, between the ACE quantitative scores and average high school marks. Here again there is a possibility that this r might be negative, the chances being about 2 in 100. These results indicate that there is not much relationship between the high school marks of girls and their ability to solve the type of quantitative problems represented by the test.

English usage and vocabulary scores show high correlations with total ACE scores (.72 ± .07 in each case). The ACE quantitative scores show a correlation of .62, and the linguistic scores of .73, with the Cooperative English Test scores.

The girls' average high school marks show a relationship of .43 with the Cooperative English Test scores, of .53 with the ACE scores, and of .47 with college achievement as represented by grade-point ratios.

Grade-point ratios of the girls give a coefficient of .28 with ACE quantitative scores, of .44 with ACE linguistic scores, and of .56 with Cooperative English Test scores.

Of the four items correlated with college achievement, it appears that Cooperative English Test scores can be best used for prediction, followed in order by average high school marks, ACE linguistic scores, and ACE quantitative scores.

The standard errors of the correlation coefficients in items involving girls show a range of ±.06 to ±.13. This rather large spread is accounted for by the fact that the girls are so few in number.

Another indication of the hazards involved in analysis from such a small group is the fact that at least three of the obtained r's might be negative if a true measure were possible.

The ratios of variance or overlapping in each pair of two variables range from a high percentage of 58 on the ACE and Cooperative English Test to a low percentage of 7 for the ACE quantitative test and average high school marks.

Obtained Relationships, Total Group.—Table XVIII may be re-examined in order to compare the various correlation coefficients of the total group.

It should be observed that some of these r's are of little value. It is logical to suppose that, where the difference in r's between boys and girls is large, nothing will be gained by combining the two groups. Such a practice would only tend to minimize the higher coefficients and inflate the lower ones.

Where the difference in r's of boys and girls is not large,

the combined group coefficient probably represents a valid measure of relationship. Of these cases, the following may be cited:

The combined group r of .72 ± .04 for Cooperative English Test and ACE linguistic scores may be compared with the obtained r's of .72 ± .04 for boys and .73 ± .06 for girls.

The combined group r of .40 ± .06 for Cooperative English Test scores and average high school marks may be compared with the obtained r's of .38 ± .08 for boys and .43 ± .11 for girls.

The combined group r of .67 ± .04 for ACE and Cooperative English Test vocabulary scores may be compared with the obtained r of .66 ± .05 for boys and .72 ± .07 for girls.

Three correlations have been computed for the total group without differentiating between the boys and girls. The results are as follows:

The combined group correlation using ACE quantitative and mathematics achievement is .43 ± .12. The large standard error is due to the fact that only 46 of the January-February freshmen completed mathematics courses. We may analyze this by stating that, for this group, 18 per cent of the variance in mathematics achievement can be associated with variance in ACE quantitative scores.

The linguistic part of the ACE has been correlated with English achievement, resulting in an r of .39 ± .07. This shows that there is, for this group, only a 15 per cent overlapping of elements in these two abilities. The number of cases involved is 136.

An r of .50 ± .06, obtained for Cooperative English Test scores and English achievement, is somewhat smaller than expected since the Cooperative English Test incorporates such things as English usage, spelling, and vocabulary. One of four things is suggested by these results: either (*a*) the test does not measure what it is supposed to measure, (*b*) the number of cases (136) is too small for reliable results, (*c*) English achievement depends on many other factors besides those incorporated in the test, or (*d*) the reliability of English marks is not very high. It is probable that a combination of any or all of these conditions exists.

Differences in Correlation Coefficients of Boys and Girls.—Table XIX shows the reliability of differences in correlation coefficients between the boys and girls on various items of data. In making up this table, only coefficients showing a difference of .10 or more have been used. The method of determining reliability of differences has been discussed in Part II of this study. The formula used in determining the standard error of the difference in coefficients of correlations is an adaptation of formula 58 in Garrett's *Statistics in Education and Psychology* (5, page 281).

The reliability of differences in the various r's for boys and girls shows the following:

The chances are 95 in 100 that the girls of this group will always outrank the boys in the relationship expressed by scores on the Cooperative English Test and the ACE Psychological Examination, and 91 in 100 in relationship expressed by scores on the Cooperative English Test and the quantitative part of the ACE.

TABLE XIX. RELIABILITY OF DIFFERENCES BETWEEN BOYS AND GIRLS INVOLVING CORRELATION COEFFICIENTS ON VARIOUS ITEMS

Items	Boys		Girls		Reliability of differences			
	r	σ	r	σ	Actual diff.	σ Diff.	$\frac{D}{\sigma D}$	Chances in 100
CE and ACE	.63	±.06	.76	±.06	.13	.08	1.63	95
CE and ACE-Q	.47	±.07	.62	±.08	.15	.11	1.36	91
ACE and CE-U	.42	±.08	.72	±.07	.30	.11	2.73	99.7
ACE and CE-S	.13	±.09	.47	±.11	.34	.14	2.43	99.3
ACE and AHSM	.40	±.08	.53	±.10	.13	.13	1.00	84
AHSM and ACE-Q ..	.36	±.08	.26	±.13	.10	.15	.67	74*
GPR and ACE-Q	.43	±.08	.28	±.13	.15	.15	1.00	84*
GPR and ACE-L	.56	±.07	.44	±.11	.12	.13	.92	82*

* Boys correlating higher than girls.

The chances are 997 in 1,000 that there is a difference greater than zero between boys and girls in the true correlations involving scores on the Psychological Examination and the Cooperative English Test in English usage, 993 in 1,000 when scores on the Psychological Examination and spelling are used, and 84 chances in 100 when scores on the Psychological Examination and the average high school marks are used. All these differences are in favor of the girls.

The chances are 74 in 100 that the difference in true correlations is greater than zero when ACE quantitative test score and average high school marks are used, 84 in 100 when scores on the ACE quantitative test and grade-point ratios are used, and 82 in 100 when scores on the ACE linguistic test and grade-point ratios are used. These last three differences are in favor of the boys.

There is, therefore, almost a certainty of reliability of differences between boys and girls on at least two correlations, rather significant differences on two others, and some reliability of differences on at least four others.

Prediction in Specific Subjects for the Total Group.—In order to predict one variable from another it is necessary to write the regression equation, which is determined by the coefficient of correlation and the standard deviations of the two variables. The equation used is Garrett's formula 60 (5, page 293).

For the regression equation in score form, formula 62 (5, page 297) is used.

From this equation the English score may be predicted from the correlation with the Cooperative English Test. It is first necessary to assign a score value to each of the letter marks used in evaluating English achievement. Since T-scores are easily handled, they have been used in this case and in other cases in this study involving letter marks. Table XX gives the T-score equivalents for various English marks taken from the obtained distribution of the 136 cases. It should be noted that the average distance from the mean in standard units has first been determined from the various percentages represented

by each mark. These z-values may be converted into T-scores by using the formula $T = 10\,z + 50$. The mean of a distribution of T-scores is 50, with a standard deviation of 10.

TABLE XX. COMPUTATION OF T-SCORES FOR THE VARIOUS LETTER MARKS USED IN EVALUATING ENGLISH ACHIEVEMENT

Marks	Number of cases	Percentage of cases	z-values	T-values
A	8	6	1.99	70
A— B+	4	3	1.44	64
B	34	25	.82	58
B— C+	13	9	.29	53
C	43	32	—.23	48
C— D+	12	9	—.83	42
D	11	8	—1.18	38
F	11	8	—1.86	31

The following data have been computed from the distributions of English achievement and Cooperative English Test scores made by the same people:

(x) *English Achievement*	(y) *Cooperative English Test*
$M = 50$	$M = 53.65$
$\sigma = 10$	$\sigma = 8.85$

$r = .50$

If these values are substituted in the equation for predicting scores, the most probable value of an English mark is found, predicted from the subject's score on the Cooperative English Test.

The degree of accuracy in this prediction is given by the equation presented in Garrett's formula 64 (5, page 300). When this formula is used, it is found that the standard error of estimating an English mark from a Cooperative English Test score is 8.66. This may be interpreted as meaning that 68 times in 100 the predicted score will not be more than 8.66 points removed from a later obtained score. To be sure, this represents a difference of only 1.34 points under a possible prediction from the standard deviation itself, but even though the improvement is small, *it is still an improvement.*

Such results as have just been outlined only emphasize the need for more accurate and reliable instruments of measurement.

The other measures which might be used in predicting specific achievement from combined group correlations would obviously be of less value, since the coefficients of correlation were smaller than the one just cited. It therefore does not seem worth while to bother with computing the equations.

Prediction of General Achievement for Boys, Using One Related Variable.—Using grade-point ratios as the criterion or predicted variable, general achievement can be predicted from the following items: (*a*) ACE quantitative scores, (*b*) ACE linguistic scores, and (*c*) average high school marks.

Using the method previously described, T-scores have been computed for the high school marks of boys as follows:

A = 68
A-B = 57
B = 49
B-C = 43
C = 34

In the remaining pages of the study the following symbols will be used to designate the criterion and predictive items:

X_1—Grade-point ratios (criterion)
X_2—ACE quantitative scores
X_3—ACE linguistic scores
X_4—Average high school marks

It will be noted that the Cooperative English Test, which could have been used in the predictions, has not been included for reasons previously mentioned.

Table XXI shows the obtained relationships as well as the intercorrelations between the criterion and various predictive items. The means and standard deviations of each distribution have been added at the bottom of the table.

TABLE XXI. RELATIONSHIPS, MEANS, AND STANDARD DEVIATIONS INVOLVING CRITERION AND PREDICTIVE ITEMS FOR BOYS*

	X_1	X_2	X_3	X_4
X_1	...	.43	.56	.53
X_2	.43	...	.59	.36
X_3	.56	.59	...	.34
X_4	.53	.36	.34	...
M	91	46.90	68.60	50
σ	93	9.10	14.45	10

* See explanation of items above.

In predicting X_1 from any of the related variables, it is necessary only to compute the three standard errors of estimate in order to decide which item may be best used in the prediction. These errors of estimate are as follows:

σ est 1.2 = 84
σ est 1.3 = 77
σ est 1.4 = 79

It is obvious, therefore, that the best prediction comes from the ACE linguistic scores (X_3). Since the b value to be used in the prediction equation is 3.61, the prediction equation reads $\overline{X}_{1.3} = 3.61X_3 - 157$, which represents the best prediction that can be made in general achievement for boys, using one related variable.

Prediction for Boys, Using Two and Three Predictive Items.—In predicting from two items, any one of three combinations may be used: (*a*) ACE quantitative and ACE linguistic scores (X_2 and X_3);

(*b*) ACE quantitative scores and average high school marks (X_2 and X_4); or (*c*) ACE linguistic scores and average high school marks (X_3 and X_4).

In order to select the best combination of these three, it is necessary to compute the partial standard deviations for each group. These partial S.D.'s may be determined from Garrett's formula 114 (5, page 423). Several partial *r*'s had to be computed in order to determine the partial standard deviations. These partial *r*'s may be determined from the general formula 113 (5, page 422). After the necessary partial *r*'s to be used have been determined and the above formula has been adapted to our needs, the results are found to be as follows:

$$r_{13\cdot2} = .42$$
$$r_{14\cdot2} = .45$$
$$r_{14\cdot3} = .44$$

These computations may be interpreted as follows: (1) The correlation between grade-point ratios and ACE linguistic scores, with ACE quantitative scores held constant, is .42; (2) the correlation between grade-point ratios and average high school marks, with ACE quantitative scores held constant, is .45; (3) the correlation between grade-point ratios and average high school marks, with ACE linguistic scores held constant, is .44.

In the above partial correlations, the partial standard deviations are:

$$\sigma_{1\cdot23} = 76$$
$$\sigma_{1\cdot24} = 75$$
$$\sigma_{1\cdot34} = 69$$

Since these partial standard deviations are the actual errors of estimate in predicting from two related variables, the best prediction is found to result from using a combination of ACE linguistic scores and average high school marks.

The partial b may be computed from Garrett's formula 117 (5, page 426). The two b's needed for the multiple regression equation may be derived from the regression equation (5, formula 116, page 426) in score form for n variables.

When the two dependent variables previously selected are used, it is necessary to compute several more partial values as follows:

$$r_{13\cdot4} = .48$$
$$\sigma_{3\cdot14} = 11.92$$
$$\sigma_{4\cdot13} = 8.44$$

The b values needed have been calculated as follows:

$$b_{13\cdot4} = 2.78$$
$$b_{14\cdot3} = 3.60$$

According to the basic prediction equation, then,

$$\overline{X}_1 = 2.78X_3 + 3.60X_4 - 278.$$

This equation gives the predicted value of the grade-point ratio of any boy when ACE linguistic scores and average high school marks are used as predictive items.

It is logical to assume that an equation involving three dependent variables may yield even better results. With the present data, only one equation of this type may be set up. As the number of

variables increases, the number of computations tends to increase in more or less geometric progression. Therefore, in order to save time, it is more feasible to compute the standard error of estimate first, in order to determine whether the accuracy of the equation will justify the work involved.

The standard error of estimating a score from three predictive items is the same as the partial standard deviation of X_1 with X_2, X_3, and X_4 held constant. The computation requires only two quantities not already found, which follow:

$$r_{34.2} = .76$$
$$r_{14.23} = .43$$

With these two values, and others previously obtained,

$$\sigma_{1.234} = 69$$

If this result is compared with that obtained in using variables 3 and 4, the standard errors of estimation are exactly the same in each case. This obviates the necessity of going to the trouble to compute the multiple regression equation for predicting from the three related variables. In other words, the prediction of general college achievement for boys, using ACE linguistic scores and average high school marks, is just as accurate as the prediction of achievement from these two items with the ACE quantitative scores added.

It has been previously stated that the grade-point ratios have a possible range of —1.00 to +3.00. For facility in writing, the decimals have been omitted, the range used in computation being —100 to 300. The distribution of these 400 points is given on page 27. These arbitrary assignments are only approximate and may vary a few points either way.

The computed standard error of prediction has been found to be ±69. It is fairly certain, then, that in the middle range a grade-point ratio can be predicted which will, 68 chances in 100, not deviate more than one whole letter mark from the true prediction. Although this does not appear too accurate, it is much better than a mere guess. It should also be pointed out that the error of estimate of 69 is an improvement of 24 points, or 26 per cent, over an estimate taken from the obtained standard deviation of the grade-point distribution.

The multiple correlation coefficient for grade-point ratios, ACE linguistic scores, and average high school marks $R_{1(34)}$ is .67. This coefficient gives the maximum correlation for boys obtainable from grade-point ratios, and from grade-point ratios estimated from a knowledge of ACE linguistic scores and average high school marks.

The square of R gives the percentage of variance in grade-point ratios attributable to the influence of ACE linguistic scores and average high school marks. About 45 per cent of the factors that cause these boys to differ in grade-point ratios is attributable to factors that cause differences in ACE linguistic scores and in average high school marks.

Prediction of General Achievement for Girls, Using One Related Variable.—The prediction for girls uses the same predicted criterion

and the same related variables as the prediction for boys, and the processes involved in computation are substantially the same.

The T-scores for average high school marks for girls have been computed from the percentages of the distribution and found to be as follows:

A—66
A-B—55
B—47
B-C—41
C—33

Table XXII shows the obtained relationships between the criterion and various predictive items, as well as the inter-correlations. The means and standard deviations of each distribution have been added at the bottom of the table.

TABLE XXII. RELATIONSHIPS, MEANS, AND STANDARD DEVIATIONS INVOLVING CRITERION AND PREDICTIVE ITEMS FOR GIRLS*

	X_1	X_2	X_3	X_4
X_1.....	...	.28	.44	.47
X_2.....	.28	...	.60	.26
X_3.....	.44	.60	...	.35
X_4.....	.47	.26	.35	...
M	115	43.60	68.30	50
σ	88	9.30	15.45	10

* See page 38.

In order to find the best single predictive item, the following computations have been made:

σ est 1.2 = 84
σ est 1.3 = 77
σ est 1.4 = 79

From this it seems that the best predictive item for girls is the scores on the linguistic part of the ACE Psychological Examination. Thus the achievement of both boys and girls may be predicted with more accuracy from this test than from either the ACE quantitative scores or average high school marks. The prediction equation reads as follows: $\overline{X}_1 = 2.51X_2 - 56$.

Prediction for Girls, Using Two and Three Predictive Items.—The three combinations of two related items represented by the data are as follows: (*a*) grade-point ratios, ACE quantitative scores, and ACE linguistic scores; (*b*) grade-point ratios, ACE quantitative scores, and average high school marks: (*c*) grade-point ratios, ACE linguistic scores, and average high school marks.

The partial *r*'s computed are:

$r_{13\cdot2} = .35$
$r_{14\cdot2} = .76$
$r_{14\cdot3} = .38$

From these and other obtained r's the partial standard deviations for each combination of items have been found to be

$$\sigma_{1\cdot23} = 79$$
$$\sigma_{1\cdot24} = 76$$
$$\sigma_{1\cdot34} = 73$$

Since these partial standard deviations are the actual errors of estimate for each combination, it is obvious that the lowest value represents the most accurate predictive combination. Thus better results in predicting general achievement for girls may be obtained from ACE linguistic scores and average high school marks than from either of the other two combinations.

The additional values needed in order to set up the prediction equation are as follows:

$$\sigma_{3\cdot14} = 13.61 \qquad \sigma_{4\cdot13} = 8.66$$
$$b_{13\cdot4} = 1.82 \qquad b_{14\cdot3} = 3.20$$

From these values, the prediction equation has been found to be $\overline{X}_1 = 1.82X_3 + 3.20X_4 - 169$. This equation gives the predicted values of grade-point ratios for girls, using the ACE linguistic scores and average high school marks as predictive items.

In order to determine whether the addition of the third dependent variable would yield more accuracy, the partial standard error of estimating grade-point ratios, with the influence of the other three items held constant, has been computed to be

$$\sigma_{1\cdot234} = 73$$

Since this is not more accurate than the obtained error of estimating from the combination of two variables, the prediction equation with three related variables has not been computed.

If the obtained error of estimation is compared to the standard deviation of the distribution of grade-point ratios, the prediction equation reduces the error of prediction by about 17 per cent. It is to be expected that, with additional similar groups, this error may be lowered still further and may subsequently be more useful in the accuracy of prediction for girls.

The multiple correlation coefficient for girls, using grade-point ratios, ACE linguistic scores, and average high school marks, is .56. This coefficient gives the maximum correlation for girls obtainable from grade-point ratios and from grade-point ratios estimated from a knowledge of ACE linguistic scores and average high school marks.

When this R is squared, it is found that about 31 per cent of the variance of girls in college achievement can be attributed to the factors that cause differences in linguistic ability and in average high school marks.

It has been noted that the predicted achievement for girls is not as accurate as for boys. This may be due to (*a*) the smaller number of cases, (*b*) the differences in reliability of various measures used when applied to the sexes separately, and (*c*) any number of other extraneous factors. To establish a true difference in total population represented by these groups would require many more cases and much further study.

Summary and Conclusions.—The data concerning the January-February freshmen have been studied for relationships and predictive value. Boys and girls have been studied separately. Correlation coefficients have been obtained, standard errors of these coefficients computed, ratios of variance determined, and, finally, prediction equations set up using first semester achievement as the criterion. The predictive variables used are (*a*) the quantitative part of the ACE Psychological Examination, (*b*) the linguistic part of this examination, and (*c*) the average high school marks. The following are the results noted and conclusions drawn:

1. The highest correlation obtained for boys is that between Cooperative English Test scores and scores on the linguistic part of the ACE Psychological Examination ($.74 \pm .04$).
2. The lowest for this same group is an r of $.13 \pm .09$ obtained in the correlation of spelling and ACE Psychological Examination scores. This coefficient might be negative on a retest, since the chances for such a result are about 7 in 100.
3. The data for boys show a relationship of .40 between average high school marks and ACE scores, of .38 between average high school marks and Cooperative English Test scores, and of .53 between average high school marks and general University achievement. General University achievement correlates .43 with the ACE quantitative scores, .56 with the ACE linguistic scores, and .49 with the Cooperative English Test scores.
4. The standard errors of the obtained r's range from $\pm.04$ to $\pm.09$ for the boys' group and from $\pm.06$ to $\pm.13$ for the girls' group.
5. Ratios of variances range from .02 to .55 for boys and from .07 to .58 for girls.
6. The highest correlation obtained for girls is $.76 \pm .06$, between scores on the Cooperative English Test and ACE Psychological Examination; and the lowest is $.26 \pm .13$, between the ACE quantitative scores and average high school marks.
7. The data for girls show a relationship of .43 between average high school marks and scores on the Cooperative English Test, of .53 between average high school marks and scores on the ACE, and of .47 between the average high school marks and general University achievement.
8. Two factors have prompted the decision to exclude the Cooperative English Test relationships from later prediction: (*a*) the correlation of scores on this test with those on the ACE linguistic is rather high for both boys and girls (.74 and .73 respectively); and (*b*) the University has temporarily discontinued the Cooperative English Test in its orientation and guidance program.
9. The test for reliability of differences between boys and girls in coefficients of correlation shows that in at least two instances —ACE and English usage scores, and ACE and spelling scores— the chances are almost certain that a difference greater than zero exists in the "true" correlations. Two others show high reliability of differences, while four others show some reliability.

10. The higher reliabilities of differences are in favor of the girls.
11. Where the difference is large between boys and girls, the combined group coefficients of correlation present a distorted picture, tending to minimize the larger obtained r's and inflate the smaller obtained r's of the differentiated groups.
12. In only three instances do the obtained r's of the combined group present a satisfactory expression of relationship as compared to the r's of the boys and girls separately. These instances are the correlations for Cooperative English Test scores and ACE linguistic scores, Cooperative English Test scores and average high school marks, and ACE Psychological Examination scores and vocabulary scores.
13. Three combined group correlations have been obtained without differentiating between boys and girls on the same items. The r obtained for ACE quantitative scores and mathematics achievement is $.43 \pm .12$; for English achievement and ACE linguistic scores, $.39 \pm .07$; and for English achievement and Cooperative English Test scores, $.50 \pm .06$. This last result is somewhat smaller than might be expected from such items of data.
14. For the combined group none of the correlations are high enough to predict specific achievement with a great degree of accuracy.
15. In predicting from two related variables, the best combination for boys is ACE linguistic scores and average high school marks.
16. The best single predictive item for general achievement of boys is the ACE linguistic scores.
17. When ACE quantitative scores are added to the above combination there is no improvement in the prediction.
18. For boys, the maximum correlation between grade-points, ACE linguistic scores, and average high school marks is found to be .67.
19. When this R is squared, it is evident that about 45 per cent of the factors that cause boys to differ in general college achievement can be attributed to the factors that cause differences in average high school marks and differences in ACE linguistic scores.
20. The best single predictive item for either girls or boys is the ACE linguistic scores.
21. The best pair of predictive items for either girls or boys is a combination of ACE linguistic scores and average high school marks.
22. It has been found that the accuracy could not be improved by adding the third predictive item.
23. For girls, the maximum correlation between grade-point ratios, ACE linguistic scores, and average high school marks is found to be .56.
24. When this R is squared, it is found that about 31 per cent of the variance in the achievement of girls is due to the factors that cause variance in linguistic ability and in average high school marks.

25. Girls appear less accurately predictable than boys. A number of factors may be operating to cause this; but it is highly possible that there is not as much difference as appears, because of the higher errors which accompany a smaller number of cases.
26. To establish real differences between boys and girls would require many more cases and much more study.

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